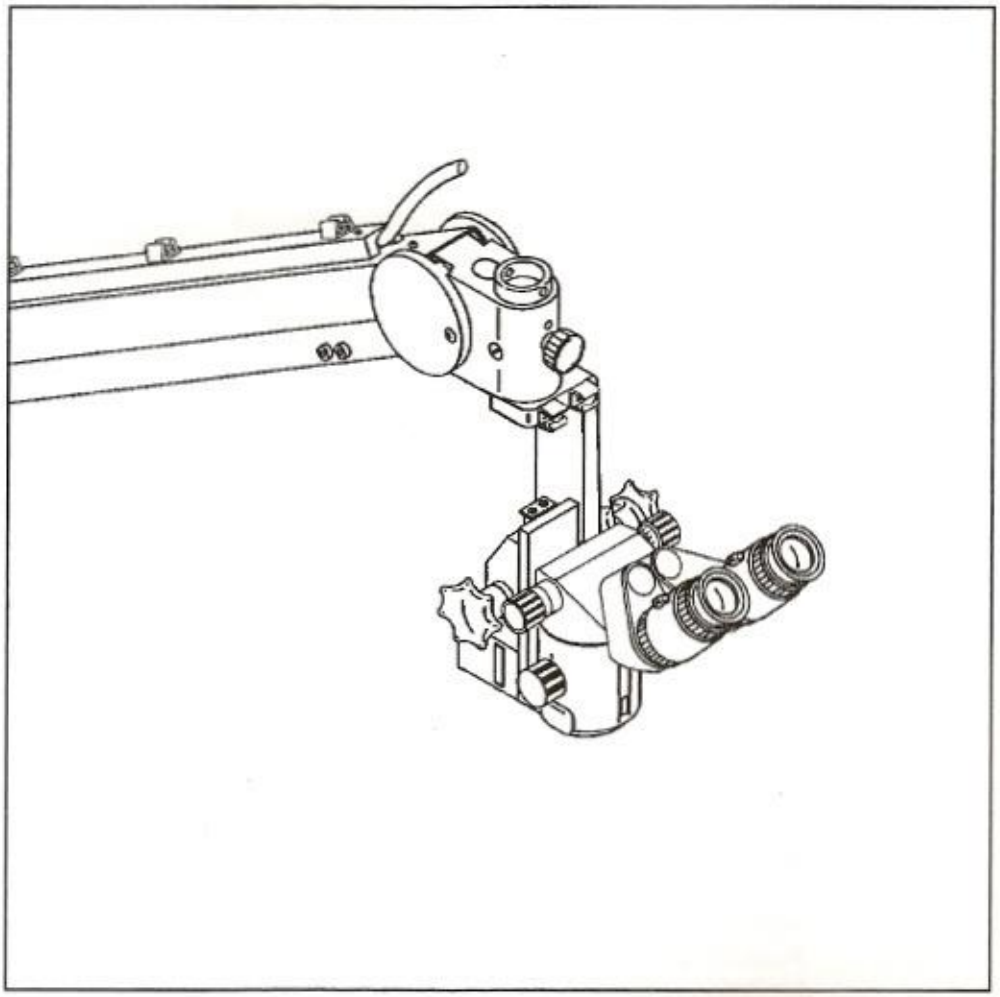
OPMI® 1 FC
Surgical Microscope



Instructions for use

G 30-1003-e
1997-02-26

ZEISS

page

Safety precautions 4

Regulations and standards 4
Notes on installation and usage 4
Phototoxic Retinal Damage in Eye Surgery 7
Warning labels and notes 8

Description 10

General 10
Safety devices 10
OPMI® 1 FC Surgical Microscope 12
Binocular tube and eyepieces 14

Installation 15

Attaching the microscope 15
Installing the binocular tube, the eyepieces and the objective ... 16
Connections 17
Re-equipping the microscope 18

Preparations for operation 19

Adjusting the balancing system 19
Positioning the stand 19
Limitation of downward movement 19
Friction adjustments 19
Illumination 19
Adjusting the surgical microscope 20

Checklist 21

page

Operation 22

Procedure 22
What to do in an emergency 22

Maintenance, further information 24

Safe working order 24
Trouble-shooting table 24
Exchanging the halogen lamp 25
Care of the microscope 26
Sterilization 26
Magnifications / Fields of view 27
Moving the S21 Floor Stand 28
Spare parts 30
Accessories 30
Asepsis 30

Technical data 31

OPMI® 1 FC Surgical Microscope 31

Important for safety

page

Safety precautions 4
Safety devices 10
Checklist 21
What to do in an emergency 22
Trouble-shooting table 24

This instrument has been developed and tested in accordance with Carl Zeiss safety standards and with national and international regulations. A high degree of instrument safety is thus ensured.

It is recommended in these regulations that the manufacturer explicitly informs the user about the safety aspects of operating the instrument. This chapter contains a summary of the most important precautions to be observed.

Further safety notes are also contained in other parts of this user's manual; they are marked with a warning triangle containing an exclamation mark as shown here. Please pay special attention to these safety notes.

Safety is only ensured when this instrument is operated properly. Please read through this manual carefully before turning the instrument on. Also read through the user's manuals of the other equipment used with this instrument. You may obtain further information from our service organization or authorized representatives.

Regulations and standards

- This instrument was developed in accordance with the following regulations, if applicable:
  - EN
  - IEC
  - UL
  - CSA

  In accordance with Directive 93/42/EEC, Supplement II, Article 3, the quality management system of Carl Zeiss has been approved by TÜV Rheinland, which is a notified authority. The registration number is: 95 102 7601
- The instrument must be connected to an emergency backup line supply in accordance with the regulations or guidelines which apply in your country.
- This is a class I medical instrument as defined by Directive 93/42/EEC.
- The declaration on CE Conformity contained in this manual is only valid for new instruments whose delivery package includes this user's manual. This declaration is invalid for old instruments which do not feature the CE marking.
- Please observe all applicable accident prevention regulations.

Notes on installation and usage

General

- Do not operate the equipment contained in the delivery package in:
  - explosion-risk areas
  - the presence of volatile anesthetics or inflammable solvents such as alcohol, benzin or similar chemicals.
- Do not station or use this instrument in damp rooms. Do not expose the instrument to water splashes, dripping water or sprayed water.
- Immediately unplug any equipment that gives off smoke, sparks or strange noises. Do not use the equipment until our service representative has repaired it.
- Do not place any fluid-filled containers on top of the instrument. Make sure that no fluids can seep into the instrument.

- Do not force cable connections. If the male and female parts do not readily connect, make sure that they are appropriate for one another. If any of the connectors are damaged, have our service representative repair them.
- If desired, the unit can be incorporated into potential equalization measures. Please contact our service representative.
- Do not use a cellular telephone in the vicinity of the equipment because the radio interference can cause the equipment to malfunction. The effects of radio interference on medical equipment depend on a number of various factors and are therefore entirely unforeseeable.
- Modifications and repairs on this instrument and on instruments used with this instrument may only be performed by our service representative or by other authorized persons.
- The manufacturer is not liable for damage caused by unauthorized persons tampering with the instrument; such tampering will also forfeit any rights to claim under warranty.
- Use this instrument only for the applications described.
- Only use this instrument with the accessories contained in the delivery package. Only use other accessory equipment when Carl Zeiss or the manufacturer of the accessory equipment has certified that its usage will not impair the safety of the system.
- Only personnel who have undergone training and instruction are allowed to use this instrument. It is the responsibility of the customer or institution operating the equipment to train and instruct all staff using the equipment.
- Keep the user's manuals where they are easily accessible at all times for the persons operating the instrument.
- Never look at the sun through the binocular tube, the objective, or an eyepiece.
- Do not pull at the light guide cable, at the power cord or at other cable connections.

Safe working order

- This instrument is a high-grade technological product. In order to ensure optimum performance and safe working order of the instrument, we recommend that our service representative inspect this instrument on a regular basis.
  If a failure occurs which you cannot correct using the trouble shooting table, attach a sign to the instrument stating it is out of order and contact our service representative.

Requirements for operation

Our service representative will install the instrument. Please make sure that the following requirements for operation remain fulfilled in the future:

- All mechanical connections (details in this user's manual) which are relevant to safety are properly connected and screw connections tightened.
- All cables and plugs are in good working condition.
- The voltage at the voltage selector on the suspension system corresponds with the rated voltage of the line supply on site.
- The instrument is plugged into a power outlet which has a properly connected protective earth connection.
- The power cord being used is the one designed for use with this instrument.

Before use

- Make sure all "Requirements for operation" are fulfilled.
- Go through the checklist.
- Re-attach or close any covers, panels or caps which have been opened or removed.
- Pay special attention to warning symbols on the instrument (triangular warning signs with exclamation marks), labels and any parts such as screws or surfaces painted red.
- Do not cover any ventilation grids or slits.

During use

- The long extension of the stand base must always point in the direction of the surgical field.
- Avoid looking directly into the light source, e.g. into the microscope objective or into a fiber light guide.
- If a light guide is not installed in one of the light guide receptacles, there is a danger of fire or burn injuries when the illumination is on.
- All types of radiation have a damaging effect on biological tissue. This also applies to the light illuminating the surgical field. For this reason, reduce the brightness and the duration of the illumination of the surgical field to the minimum required.
- When operating on the eye, always use protection filter GG 475 so that the patient's retina is not exposed to unnecessary (blue) radiation.

After use

- Be sure to turn off the instrument when not in use. Always use the main power switch to turn it off.

Re-equipping the microscope

- Put the suspension arm in the top position before changing the microscope equipment (microscope, tube, etc.). When finished, the balance setting of the suspension system must be re-adjusted.
- The weight of the surgical microscope and all of its accessories must not exceed the maximum load specified for the suspension system being used. Please refer to the user's manual of your suspension system for the maximum load allowed.
  The maximum load of the S21 Floor Stand, shown in figure 1, is 11 kg.

Phototoxic Retinal Damage in Eye Surgery

General

Several papers have been published dealing with the problems of phototoxicity during eye surgery. A comprehensive review of these publications reveals five aspects of particular concern:

- Illumination characteristics (spectral composition)
- Intensity of illumination
- Angle of illumination
- Focus of the light source
- Exposure time to the light

In the following, comments on these aspects are given and a description how Carl Zeiss, as a manufacturer, makes allowance for them in its instruments.

Illumination characteristics (spectral composition)

Studies on exposure of the eye to light of varying spectral composition date back to the early 1950's. These studies suggest that the potential hazard of phototoxic damage to the patient's retina can be reduced by blocking out the blue and ultraviolet light below a wavelength of 475 nm.
Carl Zeiss provides a GG 475 eye protection filter for surgical microscopes recommended for use in ophthalmic surgery. This reduces not only the light exposure of the patient's eye, but also that of the surgeon's.

It should be noted here that the use of filters will of necessity cause a change in the color of illumination. The physician may need to become familiar with the resulting changes in the appearance of anatomical structures.

Intensity of illumination

The majority of researchers suggest that the surgeon should use the lowest light intensity necessary to guarantee good viewing during surgery.
Carl Zeiss has addressed this concern by providing a device for continuously varying the brightness of the light source. The physician is thus able to perfectly adapt the light intensity at the patient's eye to the conditions existing in each case. Zeiss strongly discourages the use of xenon or other high-intensity light sources in ophthalmology.

Angle of illumination

A number of publications suggest that the microscope should be tilted to reduce the exposure of the macula to direct illumination.
Carl Zeiss ophthalmic surgical microscopes are therefore equipped with the following:

- Tilting mechanism for microscope body
- Oblique illumination with intensity control

Focus of the light source

Studies show that damages are likely to occur if the filament of the light source is imaged on the patient's retina. The resulting macular edema will duplicate the pattern of the illuminating filament. The peak intensity of the filament image is much higher than the peek intensity of an even and extended source like a fiber guide.
Carl Zeiss therefore recommends the use of fiber optic illumination for axial, coaxial and oblique illumination. This provides the surgical area and the retina with even and diffuse light.

Exposure time to the light

According to some publications, the phakic or aphakic eye should not be exposed to the light source longer than a few minutes. In all surgical cases, the retinal exposure time depends to a great extent on the surgical technique, the efficiency of the surgeon and possible case complications. It is therefore recommended in ophthalmic surgery to keep the light intensity as low as possible, or to use a device which prevents light from entering through the patient's pupil. Also, the surrounding light sources should not cause additional strain to the eye.
Carl Zeiss has provided an answer to this problem in the form of a swing-in retinal protection device for insertion into the beam path of the surgical microscope. This device ensures total eclipsing of the pupil, preventing light from entering through it. It can be swung out when a red reflex is required.

In conclusion

Carl Zeiss recommends:

- Use of the GG 475 eye protection filter
- Reduction of the illumination of the surgical area to the extent required for the patient's safety and for microscopic visualization
- Tilting of the microscope body as required
- Insertion of the retinal protection device
- Reduction of the patient's eye to light exposure from surrounding light sources

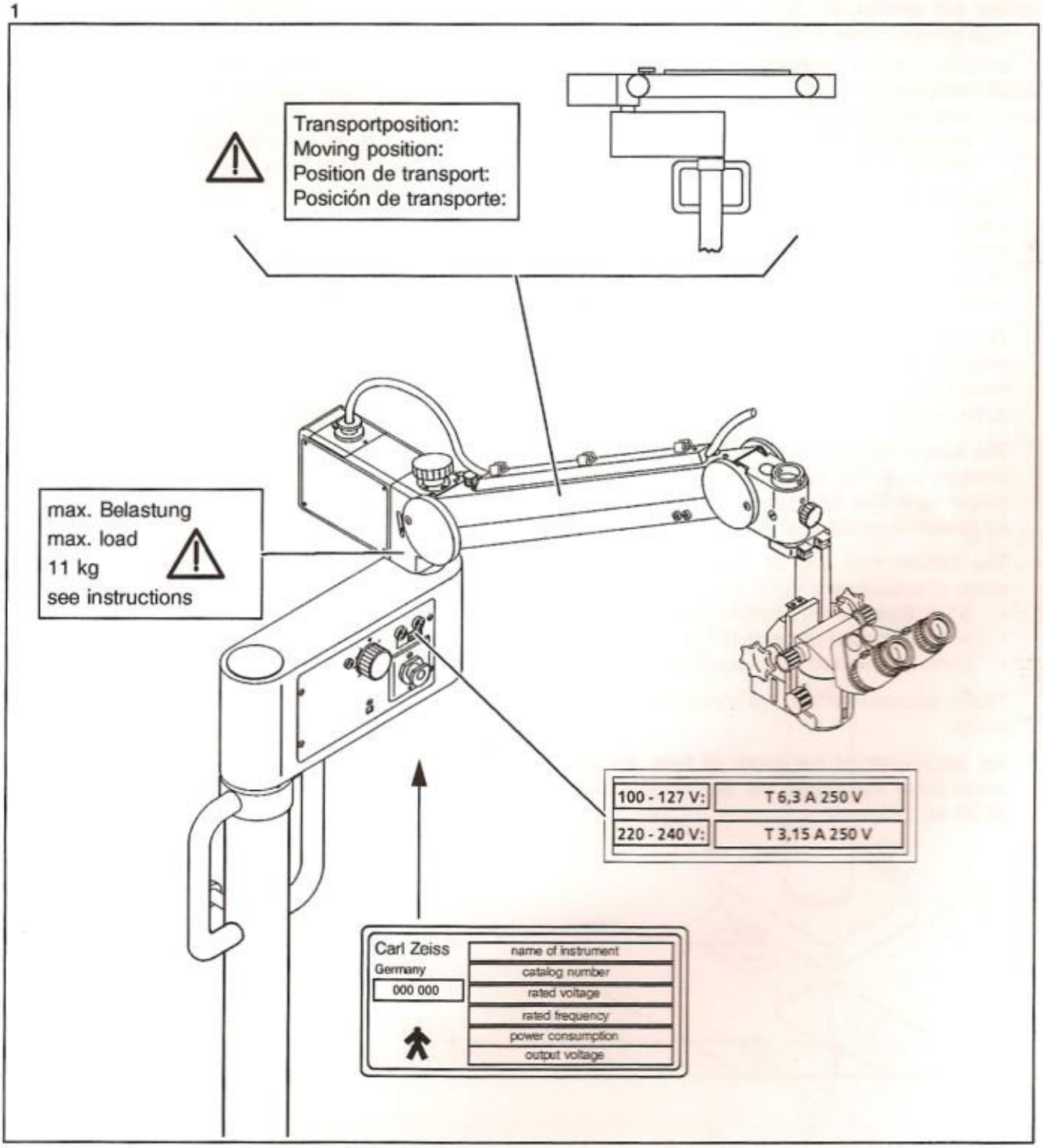
These measures should help the surgeon to reduce the likelihood of phototoxic retinal damage.

Warning labels and notes (figure 1)

Caution:
Observe all warning labels and notes!

If any label is missing on your instrument or has become illegible, please contact us or our authorized representative. We will supply the missing labels.

1


Transportposition:
Moving position:
Position de transport:
Posición de transporte:
max. Belastung
max. load
11 kg
see instructions
100 - 127 V:
T 6,3 A 250 V
220 - 240 V:
T 3,15 A 250 V
Carl Zeiss
Germany
000 000
name of instrument
catalog number
rated voltage
rated frequency
power consumption
output voltage

General

The OPMI® 1 FC is a manually-operated, multi-purpose surgical microscope designed for use in all disciplines as a

- surgical microscope
- examination microscope
- training and dissecting microscope.

The OPMI® 1 FC is equipped with a 5-stage magnification changer which is operated manually. Fine-focussing is done at the focus knob located on the microscope body. The focus drive has a range of 50 mm.

To change the viewing angle, you can tilt the microscope in stepless motion. The friction of the tilt motion and the focussing motion can be adjusted to the weight of the microscope equipment.

The suspension system is equipped with a 100 W halogen lamp. The light is conducted to the microscope via a fiber light guide. This system provides for coaxial illumination of the field of view.

The OPMI® 1FC can be equipped with a wide range of accessories:

- 8° or 0° assistant's microscope
- various coobservation systems
- photographic and video equipment

These accessories can be mounted quickly and easily.

For adjustment of the depth of field, we recommend using the double iris diaphragm, order no. 30 33 54. 0000.

Note:
This user's manual describes the OPMI® 1 FC together with other units and accessories (e.g. the S21 Floor Stand). The system described herein represents a common instrument configuration which may differ from your system. The description generally applies for other similar configurations as well. Some of the accessories and features mentioned may not be in your configuration: The scope of the delivery package is specified in the delivery papers.

Safety devices

(figure 2)

1 Retinal protection filter GG 475
When operating on the eye, always use protection filter GG 475 so that the patient's retina is not exposed to unnecessary (blue) radiation.

2 Thermal circuit break
The thermal circuit breaker switches off the halogen lamp in the lamp module when it overheats. If this happens, you must correct the cause of the overheating. For example, drapes might be covering the ventilation slits. Press the thermal circuit breaker back in after the halogen lamps have cooled down.

3 Adjustment screw for limitation of downward movement
The safety slider is used to limit the minimum vertical working distance to the field of surgery. This setting must be adjusted before surgery.

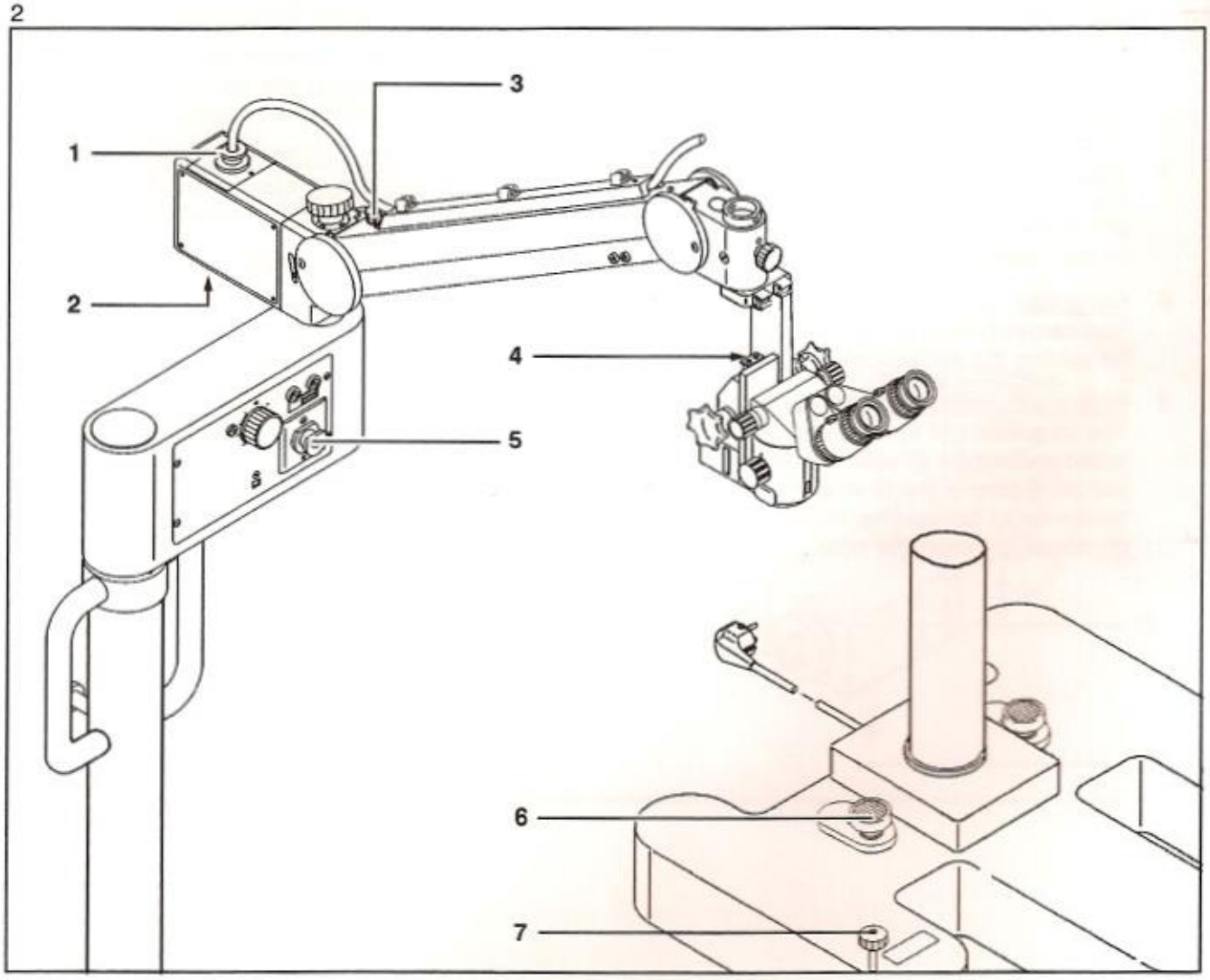
4 Potential equalization connection
This connection can be used to incorporate the unit in potential equalization measures.

5 Back-up lamp module
If one of the fiber illuminations fail, pull out the defective lamp module and insert the back-up lamp module. Exchanging the halogen lamp is described on page 25.

6 Lock knobs
Press these knobs in to lock the stand in its position on the floor. To release the knobs, press in the toe-plates located underneath.

7 Lock screws
In addition to lock knobs (5), tighten these screws to lock the stand in its position on the floor.

2



OPMI® 1 FC Surgical Microscope
(figure 3)

1 Securing screw
This securing screw retains the microscope in the reception bore of the stand and secures it from falling out. Be sure to screw in this screw firmly (using a suitable tool) as far as it will go.

2 Rotation shaft
Before inserting the rotation shaft of the microscope into the reception bore of the suspension system or the tilt coupling, lubricate the shaft lightly with grease F30 (cat no. 0092 214).

3 Light guide clip

4 Securing screw
After installing the binocular tube or another unit,in the receptacle of the microscope, tighten this screw firmly as far as it will go.

5 Cover cap
You can remove this cap and install a handle for guiding the microscope.

6 Friction adjustment knob for tilt motion
The tilt position of the microscope can be adjusted around the tilt axis. Use this knob to adjust the friction of the tilt motion. Turn the knob clockwise to tighten the friction and counterclockwise to loosen the friction.

7 Focusing knobs (located on both sides)
Adjust the friction of the focusing drive by turning the two knobs in opposite directions.

8 5-stage magnification changer
Five different magnifications can be selected. The number indicated at the black line shows magnification factor γ of the magnification changer:
$\gamma = 0.4$; $\gamma = 0.6$; $\gamma = 1.0$; $\gamma = 1.6$; $\gamma = 2.5$x.
You can calculate the magnification of the entire system and the diameter of the field of view as described on page 27.

9 Potential equalization connection
This connection can be used to incorporate the unit in potential equalization measures.

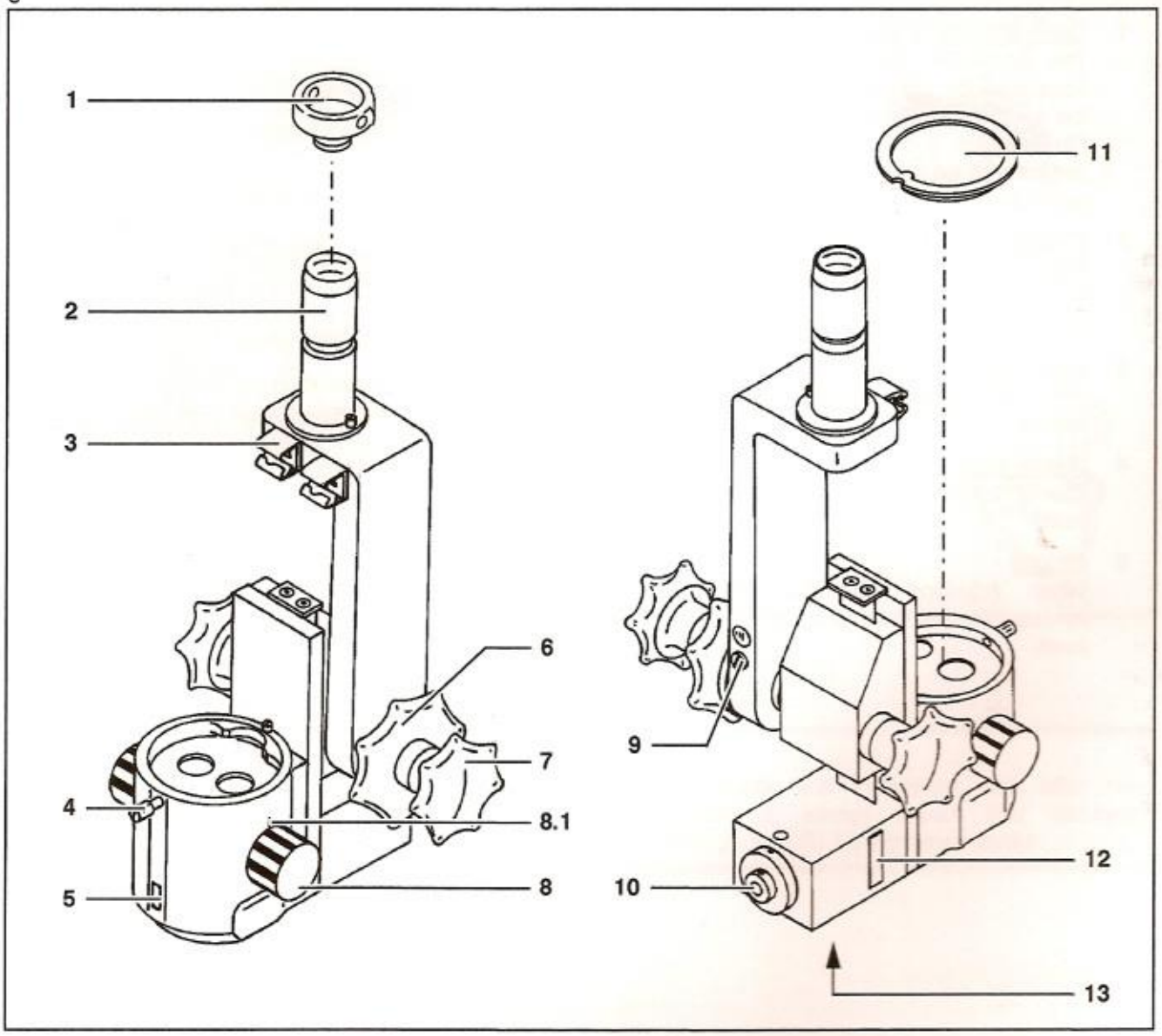
10 Light guide receptacle

11 Dust cover
Remove this cover before installing the binocular tube or a different unit.

12 Cover cap for filter slider
A filter slider can be installed here after removing the cap.

13 Screwholes for attaching dovetail mount
A dovetail mount (cat. no. 30 33 60- 9903) for accessory equipment can be installed on the bottom of the microscope.

3



Binocular tube and eyepieces (figure 4)

1 Catch lever for diopter adjustment
The eyepieces are equipped with ametropia compensation between –8 to +8 D. To adjust the eyepiece, press in the catch lever and turn the eyepiece in the + or - direction. The setting cannot be inadvertently changed after the catch lever has snapped back in.

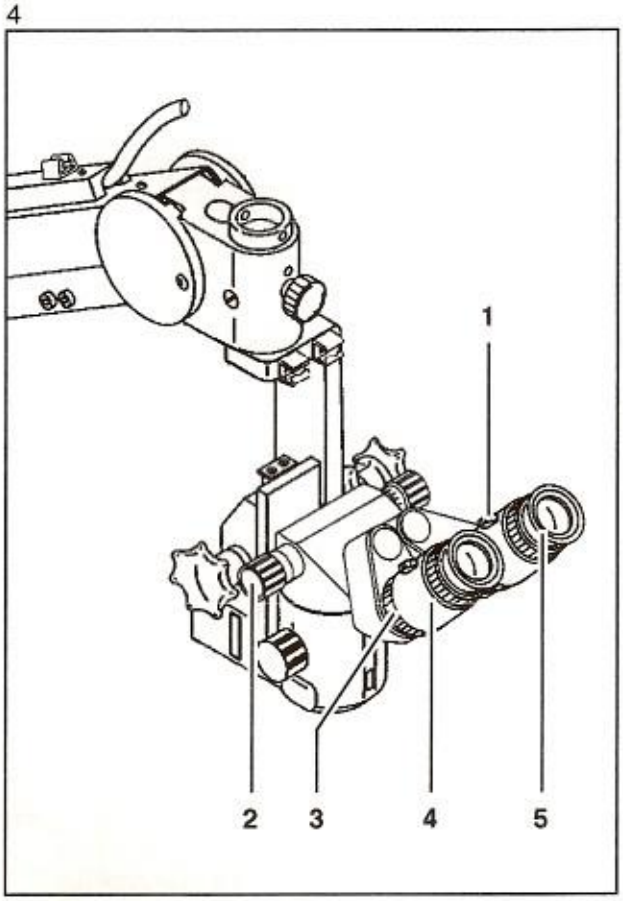
2 PD adjustment knob
Adjust the interpupillary distance with this knob. When adjusted correctly, the image is visible as one image through both eyepieces.

3 Screw ring
When attaching the eyepieces, tighten this ring firmly.

4 Diopter scale
The refractive power is shown on the diopter scale.

5 Eyecup
When adjusting the eyepieces, set the eyecups so that the entire field of view can be seen.

4



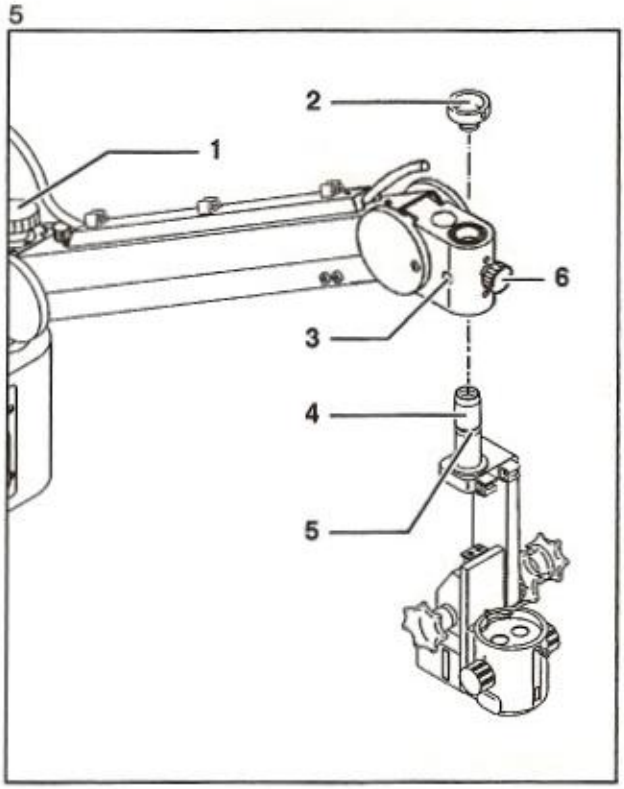
Note:
The principle described in this chapter also applies for all other suspension systems.

Attaching the microscope (figure 5)

Caution:
The weight of the microscope and all the accessories must not exceed maximum 11 kg when using the S21 Floor Stand.

- Turn the balance adjustment screw (1) clockwise until the weight compensation scale reads 11 kg. When doing this, move the suspension arm a bit up or down to the position where screw (1) turns easily.
- Loosen securing screws (3) and (6) a few turns.
- Lubricate the microscope rotation shaft (4) with grease F30 (cat. no. 0093 214).
- Insert the microscope rotation shaft (4) into the reception bore of the suspension arm. Tighten securing screw (2) using a suitable tool (e.g. a pin key).
- Tighten securing screw (3) firmly. The securing screw (3) must engage groove (5). This is ensured when securing screw (3) is flush with the surface of the suspension arm.

5



Caution:
Before using the instrument and after re-equipping it, always ensure that securing screws (2) and (3) are tightened firmly!

Installing the binocular tube, the eyepieces and the objective (figure 6)

- Loosen securing screw (5) a few turns.
- Remove cover (1) and store it.
- Place binocular tube (4) onto the surgical microscope and tighten securing screw (5) firmly.

Note:
Other components may be installed between the microscope and the tube. These components are secured in the same manner using securing screw (5).

- Screw the eyepieces (2) onto the eyepiece mounts and tighten knurled rings (3) firmly.

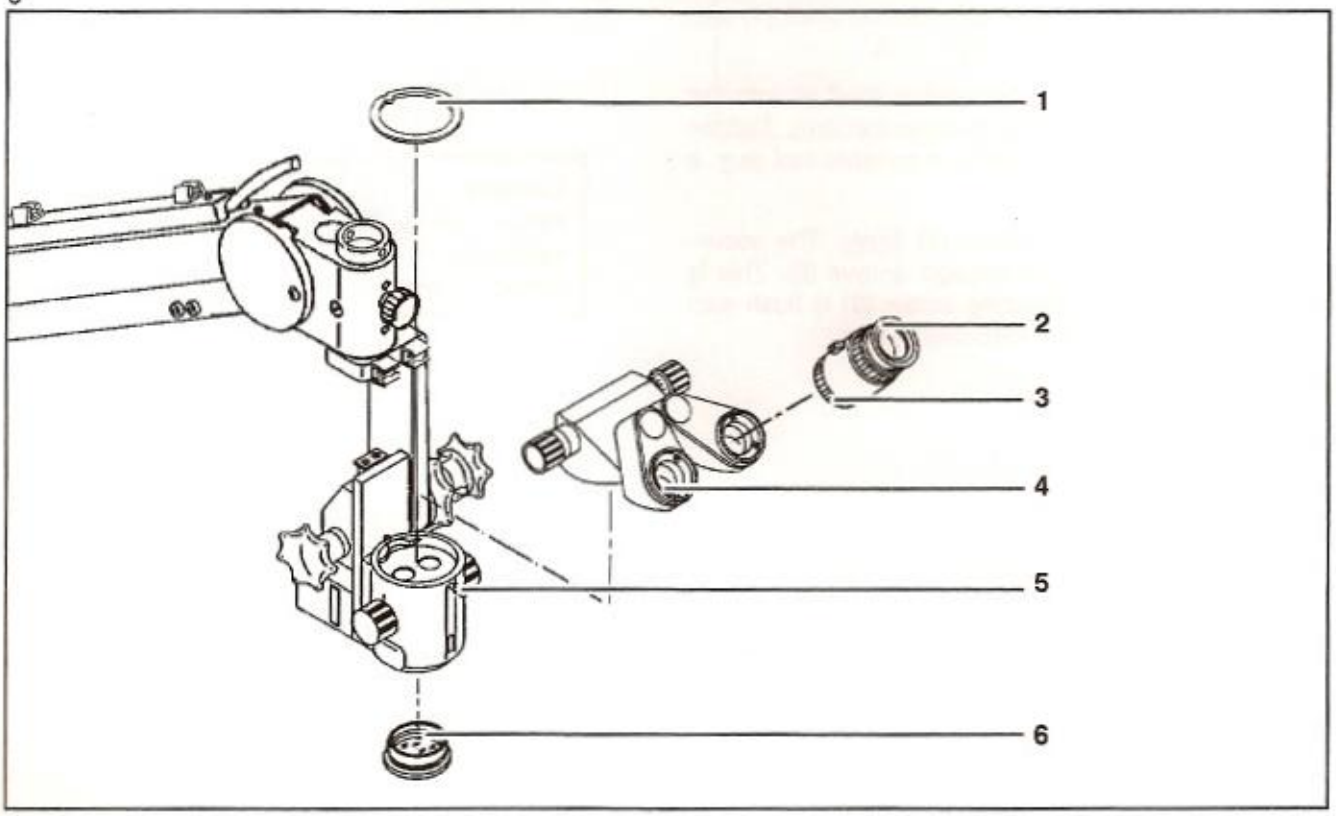
Note:
If a documentation device is used, an eyepiece with a reticle can be used as a focusing aid. Installation of the reticles can only be done in the factory or by our service representative. Always use the eyepiece equipped with the reticle on the same side of the binocular tube as the documentation equipment is installed.

- Screw the objective (6) into the microscope body and tighten firmly.

Caution:
Before using the instrument and after re-equipping it, always make sure the following are securely mounted:
- binocular tube (4)

Make sure the following are tightened firmly:
- knurled rings (3)
- securing screw (5)
- objective (6)

6



Connections

(figures 7, 8 and 9)

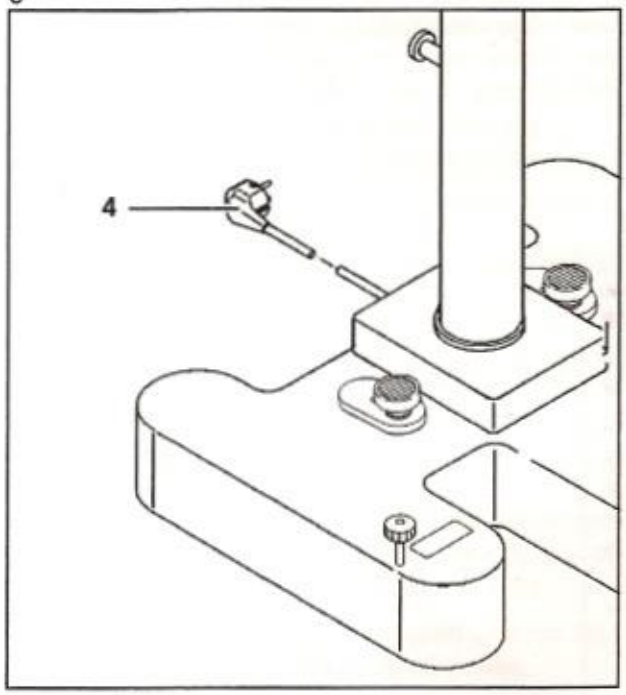
- Check the voltage setting at (3).

Notes:

- The instrument is set at the factory for the voltage of the destination country. The setting indicated by (3) must be the same as the available line voltage. If not, our service technician will have to re-wire the instrument.
- Turn the unit off at the power switch (2) before plugging in or unplugging the power cord.

- Plug the power cord (4) into a wall outlet. Only plug the power cord into a power outlet which is equipped with a properly connected ground contact.
- Insert the light guide into light guide receptacle of the microscope and into light guide receptacles (1) and (5), and then press the light guide into clips (6). There must be enough slack in the light guide so that it is not stretched when the microscope is tilted or rotated.

8



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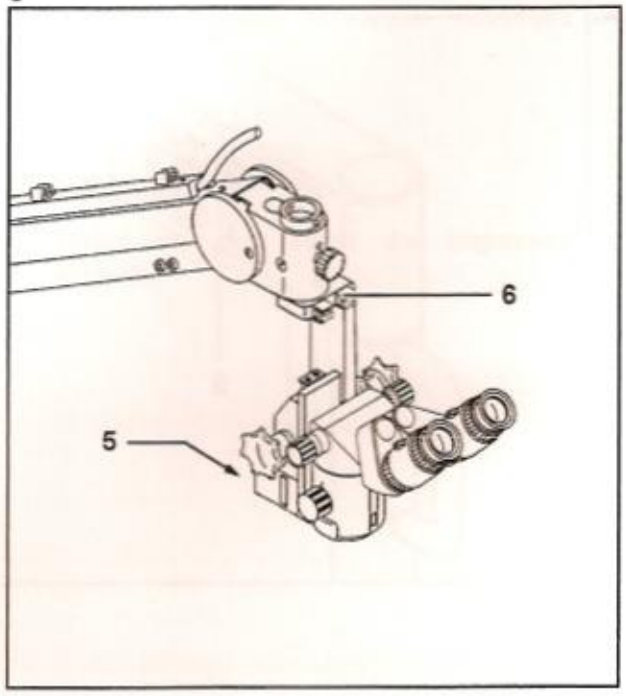

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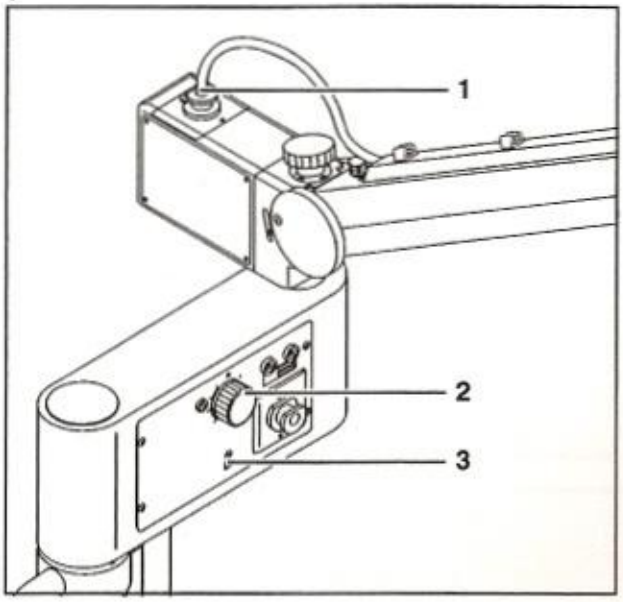
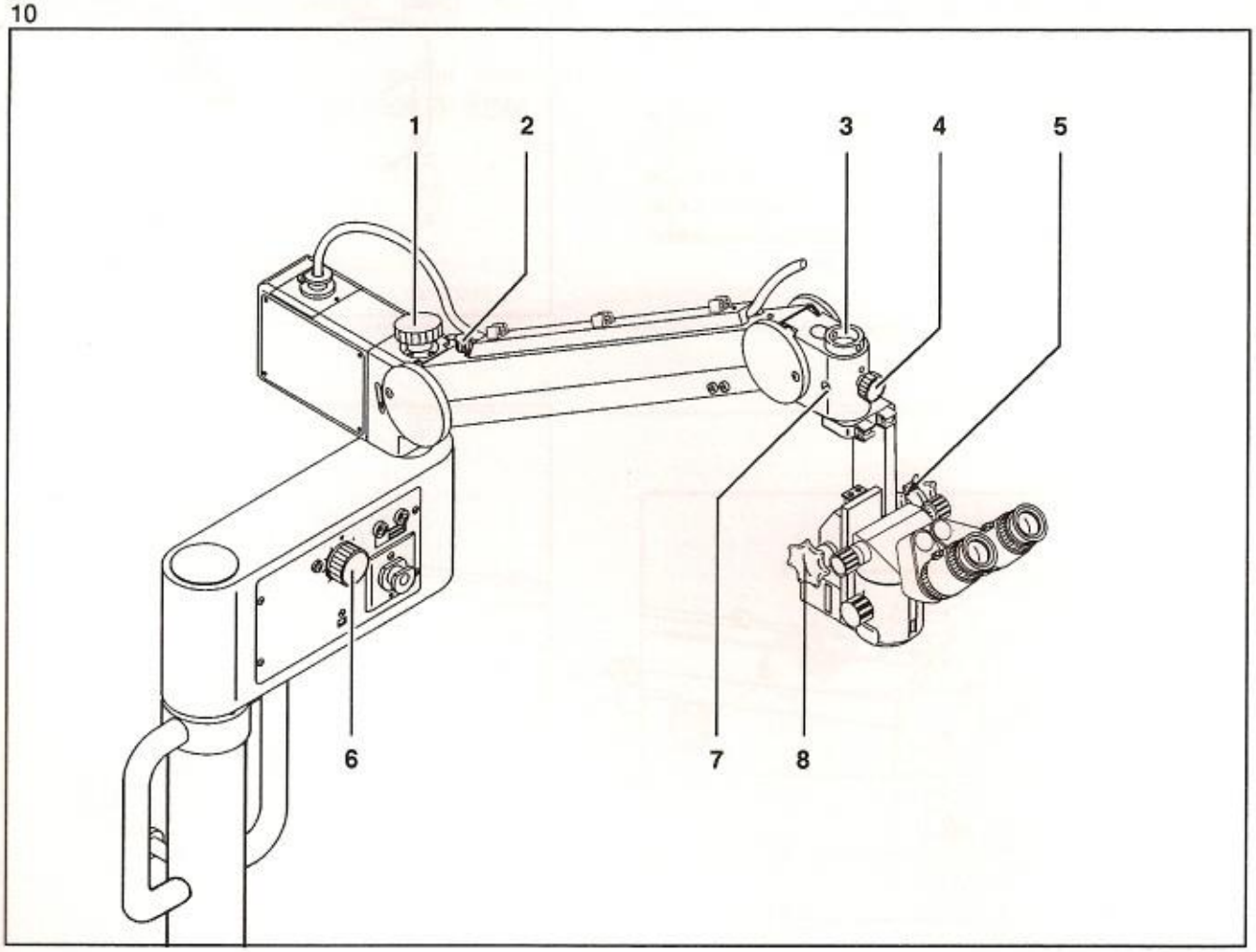


Re-equipping the microscope (figures 10 and 11)

- Turn the balance adjustment screw (1) clockwise until the weight compensation scale reads 11 kg. When doing this, move the suspension arm a bit up or down to the position where screw (1) turns easily.
- Remove the microscope accessories in reverse order as described on pages 15 to 17.
- Re-equip the microscope as described on pages 15 to 17.

Caution:
Hold on to the microscope tightly when loosening securing screws (3) and (7).

10



Adjusting the balancing system (figures 10 and 11)

- Lift the microscope a bit with your hand until you find a position where the balance adjustment screw (1) can be easily turned.
- Adjust balance adjustment screw (1) to where the microscope no longer moves up or down when you let it loose.
- Check the balance adjustment in various positions and finely adjust. When properly balanced, the microscope should remain in any position it is put into. The effort required to move it up and down should be the same.

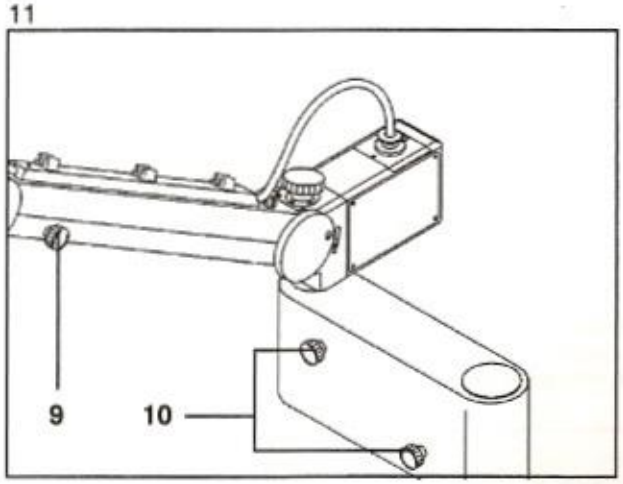
Positioning the stand

See also "moving the stand", page 28.

Caution:
The long extension of the stand base must always point in the direction of the surgical field.

- Press down the floor lock knobs (pos. 8, page 29) so that the stand cannot be rolled away.
- Screw in the lock screws (pos. 9, page 29).

11



Limitation of downward movement

The downward movement of the suspension arm can be limited so that the microscope cannot be accidentally lowered to where there is a risk to the patient.

- Adjust knob (2) so that the microscope cannot be lowered beyond a minimum safety distance to the patient.
  Check the stop setting by lowering the surgical microscope to the stop.

Friction adjustments

- Adjust the friction of the horizontal movement of the suspension system and the rotation of the microscope using knobs (4) and (10).
- Adjust the friction of the tilt motion at knob (5). Tighten the friction by turning clockwise.
- Turn the focusing knobs (8) in opposite directions to adjust the friction of the focus drive.
- Adjust the friction of vertical movement at knob (9).

Illumination

- Switch on and adjust the brightness at knob (6).

Adjusting the surgical microscope

Bring the surgical microscope into starting position within the focusing range.
Set the minimum magnification on the surgical microscope.
Bring the surgical microscope into working position.
Adjust interpupillary distance on the binocular tube.
Set diopter scales on eyepieces.
Note that instrument myopia may occur.

Emmetropes
set the diopter scale to 0 diopter (D).

Eyeglass wearers
(who perform surgery wearing their glasses) set the diopter scale to 0 diopter (D).

Ametropes
(who know their refractive powers and perform surgery without wearing their glasses) set the diopter scale ring to their refractive powers.

Ametropes (who do not know their refractive powers)

Set both eyepieces to +8 D.

Eyepieces without reticles:

Remove binocular tube and eyepieces from the microscope body and point them at a distant object*), i.e. use them like a pair of binoculars. The image of the object is still unsharp.

Turn diopter scale ring of one eyepiece slowly clockwise until the image of the object is sharp. Stop turning the ring. If necessary, repeat this procedure three times and take the average of the readings found. Adjust the second eyepiece in the same manner.

Replace tube and eyepieces on microscope body and tighten securing screw firmly.

Eyepieces with reticles:

Turn diopter scale ring on eyepiece slowly clockwise until the reticle is imaged sharply. Stop turning the ring.

Focus the surgical microscope on the object. The reticle and the object must be sharp at the same time.

Adjust the second eyepiece in the same manner until the object is seen sharply.

Adjust eyecups in such a way that the full field of view can be seen.
Set maximum magnification on the microscope and focus on object.
Set working magnification required. When the magnification is changed, the focal plane is retained, but the depth of field changes.

Note: If several surgeons use the instrument, it is advisable to draw up a table with the individual refractive powers of each of the surgeons and to keep it in a handy location near the instrument.

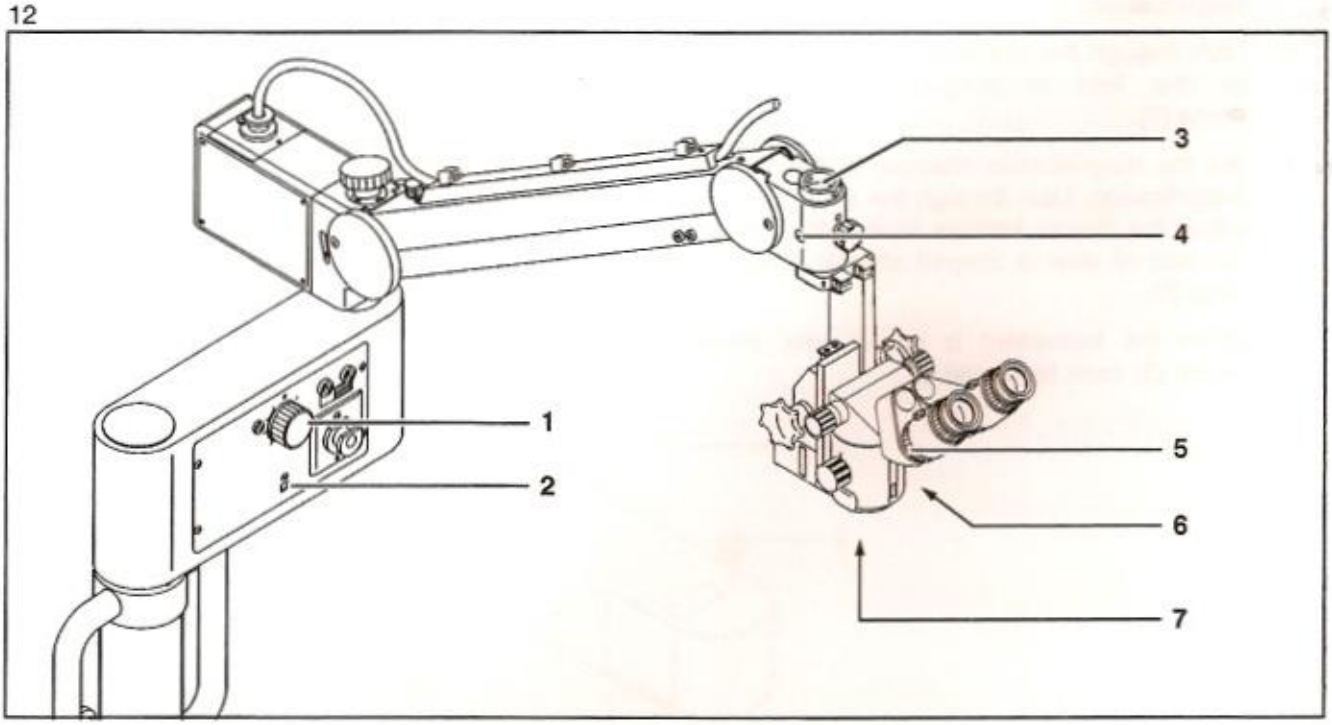
*) **Caution:** Never point at the sun.

The following points must always be checked (without the patient) before surgery (figure 12):

- The power cord is properly plugged in.
- The correct rated voltage is indicated at position (2).
- Securing screws (3), (4), and (6) are tightened firmly.
- Knurled rings (5) and objective (7) are tightened firmly.
- Power switch (1) is on.
- The halogen lamp and the lamp in the backup lamp module function properly.
- The light guide is properly installed.
- The balance system of the suspension arm is properly adjusted.
- The friction adjustment for tilt motion is set as required.
- The friction adjustment of the focusing drive is set as required.
- The limitation of downward movement is set as required.
- The friction of the microscope rotation is set as required.
- The friction of the vertical movement of the suspension arm is set as required.
- The friction of the horizontal movement of the suspension arm and carrier arm is set as required.

Caution:
If a malfunction is detected, for safety reasons it is not allowed to operate using this instrument. If possible, correct the fault (see troubleshooting table, page 24) or contact our service dept.

12



Procedure (figure 13)

- All preparations have been completed. See page 19.
- The instrument has been checked in accordance with the checklist.
- Re-check the setting of the minimum working distance to the field of surgery.
- Switch on the instrument at power switch (3) and adjust the brightness of the illumination.
- Move the microscope over the field of surgery to the desired position.
- Adjust the focusing to the middle of the focusing range.
- Set the magnification changer (8) to the lowest magnification.
- For coarse focusing, look through the eyepieces and lower the surgical microscope using the suspension arm to where the field of surgery is visible.
- Set the magnification changer to the highest magnification.
- Look through the eyepieces and focus sharply on the field of surgery using focusing knobs (7).
- Set the magnification changer to the desired magnification. Look through the eyepieces and adjust the diopter settings so that the edge of the field of view is imaged sharply. See also page 20.
- When the instrument is not in use, power switch (3) must be turned off.

Caution:
- Never look directly into the light source, e.g. into the microscope objective or into a fiber light guide.
- When operating on the eye, always use protection filter GG 475 so that the patient's eye is not exposed to unnecessary radiation (blue light causes retinal damage).

What to do in an emergency (figure 13)

Lamp failure

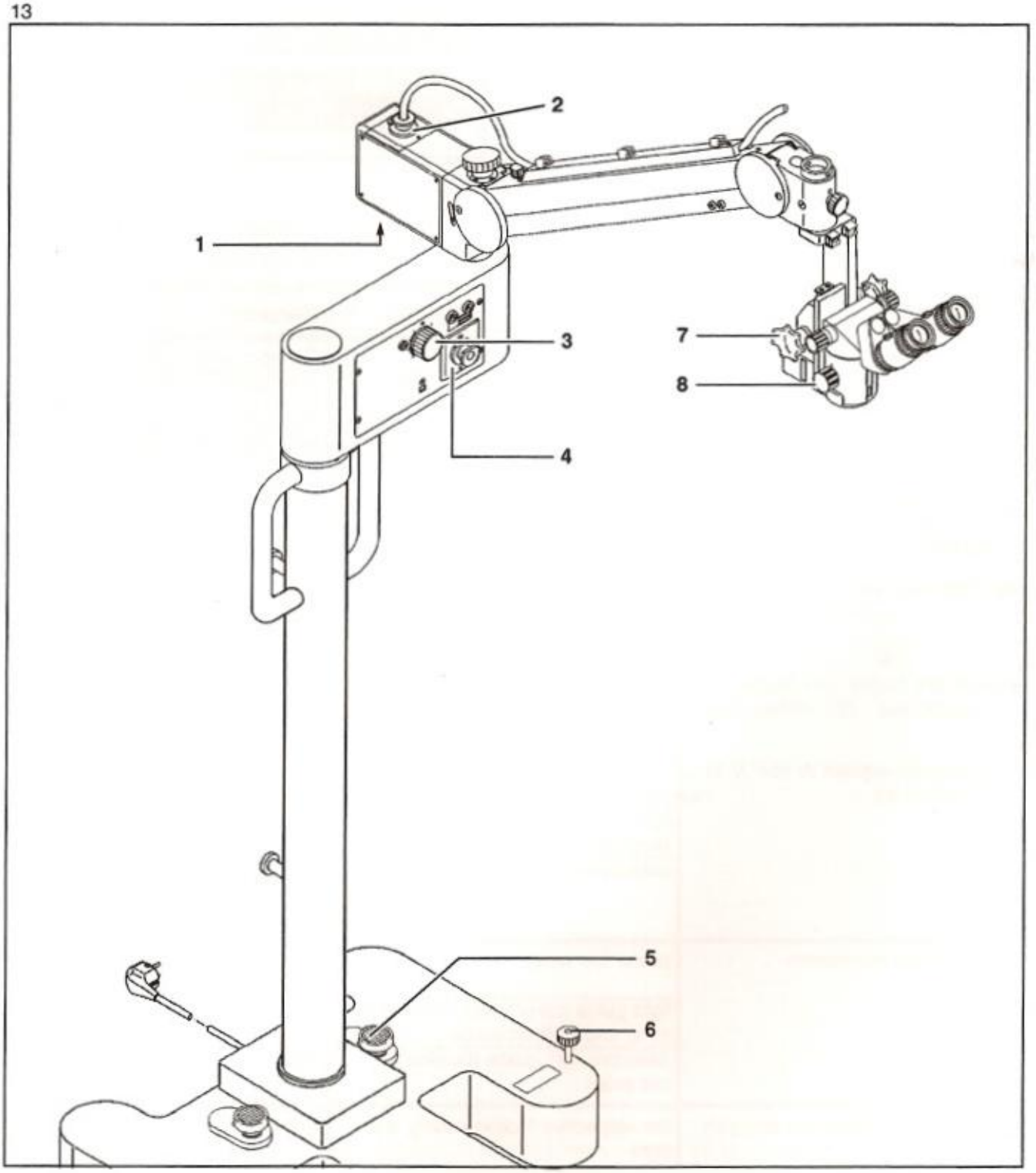
When thermal circuit breaker (1) has been activated:

- First correct the cause of the overheating. For example, drapes might be covering the ventilation slits. Press the thermal circuit breaker (1) back in after the halogen lamps have cooled down.

Lamp bulb has gone out:

- Switch off the instrument at main switch (3) and disconnect the light guide at lamp module (2).
- Remove lamp module (2) and install the back-up lamp module (4) in the lamp housing.
- Re-connect the light guide. Switch the stand back on and adjust the brightness at knob (3).

13



Safe working order

This instrument is a high-grade technological product. In order to ensure perfect and safe working order of the instrument, we recommend that our service representative inspect this instrument on a regular basis.

Trouble-shooting table

If a malfunction occurs which you cannot remedy using the trouble-shooting table, attach a label to the instrument stating it is out of order and contact our service department.

Problem	Possible Cause	Remedy
no function at all	power plug not connected	Connect power plug.
	main power switch in 0 position	Turn main switch out of 0 position. Green pilot light must come on.
	power failure	Contact in-house electrician.
	fuse in suspension system blown	Contact in-house electrician.
microscope illumination not working properly, but the green light in the power switch is on	halogen lamp not turned on	Turn on illumination at main power switch.
	halogen lamp defective	Use back-up lamp module. Change the lamp (see page 25).
	ceramic base does not have proper contact to halogen lamp	Plug the ceramic base firmly onto the contacts of the halogen lamp
	lamp module does not have proper contact	Push in lamp module as far as it will go.
	thermal circuit breaker (2), see page 11, activated	First correct the cause of overheating. When the lamp module has cooled down again, press the thermal circuit breaker back in.
	light guide not properly inserted at lamp and/or microscope	Insert light guide as far as it will go.
	defective or electronics in stand	Illuminate area of surgery with surgical lamp. Contact service technician.
insufficient illumination	power too weak	Adjust illumination using main power switch.
	light guide not properly inserted at lamp and/or microscope	Insert light guide as far as it will go.
	defective light guide (illumination not even)	Install new light guide.
microscope movement sluggish	the respective friction setting is too tight	Loosen friction setting.

Exchanging the halogen lamp (figure 14)

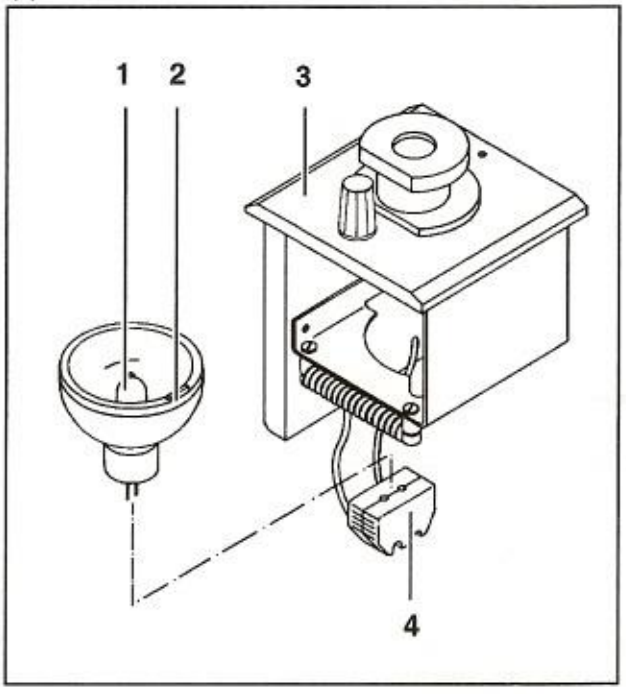
Caution:
When you exchange the lamp bulb shortly after it has gone out, wear heat-insulating gloves to prevent burns!

Note:
If the halogen lamp goes out during surgery, you can continue by using backup lamp module. For this reason it is important to check the bulb in the backup lamp module before surgery.

To exchange the halogen lamp bulb, proceed as follows:

- Turn off the illumination at power switch (2), see figure 13, page 23.
- Unplug the light guide at the lamp module.
- Pull out lamp module (3).
- Pull the ceramic base (4) off of the contact pins of the halogen lamp bulb.
- Pull the halogen lamp out of the spring holding device.
- Install the new halogen lamp bulb. Observe the following points:
  - The centering nose (2) must fit into the hole.
  - Do not touch the lamp bulb (1) or the interior of the lamp reflector.
- Slide the ceramic base (4) onto the contact pins of the lamp.

14



- Install the lamp module (3) with the new halogen lamp bulb into the mount.
- Reinstall the light guide.
- Switch on the mount and adjust the illumination at power switch (2), see figure 13, page 23.

Note: Only use 12 V, 100 W halogen lamp bulbs.
Catalog number: 38 00 79- 9040

Care of the microscope

Cleaning optical surfaces

The multilayer T* (T-star) coating of our optical components (e.g. eyepieces and objectives) results in optimum image quality.

The image quality is impaired by even slight contamination of the optics or by a fingerprint. For this reason, when the microscope is not being used it should never be left without the objective, binocular tube and eyepieces installed. After use and cleaning, cover the microscope with a dust cover. Always store objectives, eyepieces and accessories which are not being used in dust-free cases.

The external surfaces of the optical components (eyepieces, objectives) should be cleaned only when necessary:

- Do do use any chemical cleaning agents.
- Blow off dust on the optical surfaces using a squeeze blower or a grease-free brush.
- Thorough cleaning is now extremely easy and can be quickly performed with our recommended moist antistatic cleaning cloths.
  Please follow the instructions on the packing of the cleaning cloths.

In this manner the optical image will remain brilliant and high in contrast.

Pack of 100 cleaning cloths:
Catalog no. 30 61 18- 0000

Prevention of fogging

To prevent the eyepieces from fogging, you may treat them with our anti-fogging agent.
The anti-fogging agent consists of a dry, chemical solid in the form of a stick and produces a dry film when applied to the eyepieces. This film protects against fogging without causing any damage to the T* coating. The anti-fogging agent contains neither wax nor silicone; it is unpoisonous and does not scratch glass.

Every pack of anti-fogging agent (contains 1 stick) includes instructions for use which we would ask you to observe.

Important: Spread the anti-fogging agent film with a dry cotton cloth - do not use paper!

Anti-fogging agent:
Catalog no. 30 55 50- 9910

Cleaning painted surfaces

All parts of the instrument can be cleaned by wiping with a moist cloth. Do not use any aggressive or abrasive cleaning agents.

Wipe off any residue with a mixture consisting of 50% ethyl alcohol and 50% distilled water plus a dash of dishwashing liquid.

Sterilization

The asepsis set available from Carl Zeiss contains rubber caps, sleeves and grips which can be sterilized in conventional autoclaves. We recommend either of the following programs for sterilization:

- Sterilization temperature : 120° C
  Sterilizing time : 20 minutes
- Sterilization temperature : 134° C
  Sterilizing time : 5 minutes

Sterile single-use drapes are available to cover the instrument.

Magnifications / Fields of view

Using the magnification factor, which can be read in magnification window (8), page 13, you can calculate the total magnification of the microscope.

If:

f_{tube} is the focal length of the binocular tube,

f_{obj} is the focal length of the main objective,

γ is the factor set on the zoom system,

M_{eye} is the magnification of the eyepiece,

then the total magnification of the surgical microscope can be calculated according to:

$$M_T = \frac{f_{tube}}{f_{obj}} \cdot \gamma \cdot M_{eye}$$

Example:

f_{tube} = 170 mm, f_{obj} = 200 mm, γ = 1.6 and M_{eye} = 10 x.

The total magnification is thus:

$$M_T = \frac{170}{200} \cdot 1.6 \cdot 10 = \underline{13.6}$$

If total magnification M_T of the surgical microscope is known, the field of view diameter (FoV_D), i.e. the circular area of the surgical field which can be seen through the microscope when used properly, can be calculated according to:

$$FoV_D = \frac{FoV_N \cdot M_{eye}}{M_T}$$

FoV_N in the above formula stands for the field-of-view number, which is marked on our widefield eyepieces.

Using M_T = 13.6 from the example above, the field-of-view diameter is thus:

$$FoV_D = \frac{22\ mm \cdot 10}{13{,}6} = \underline{16.2\ mm}$$

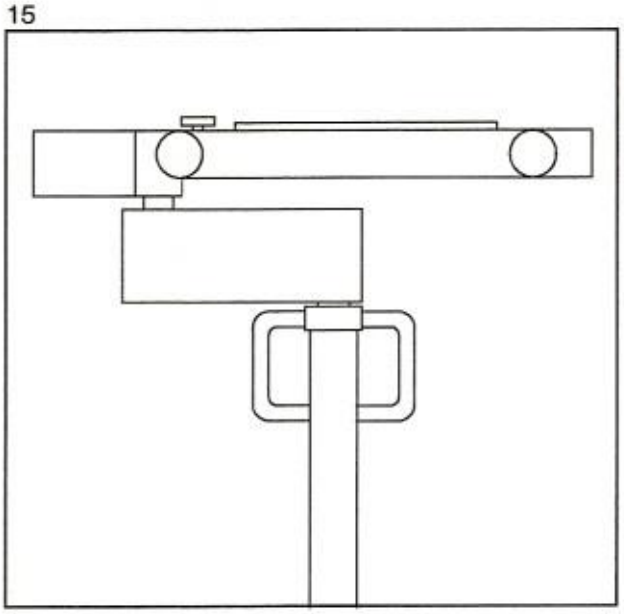
Moving the S21 Floor Stand

(figures 15 and 16)

Observe the following points when moving the instrument:

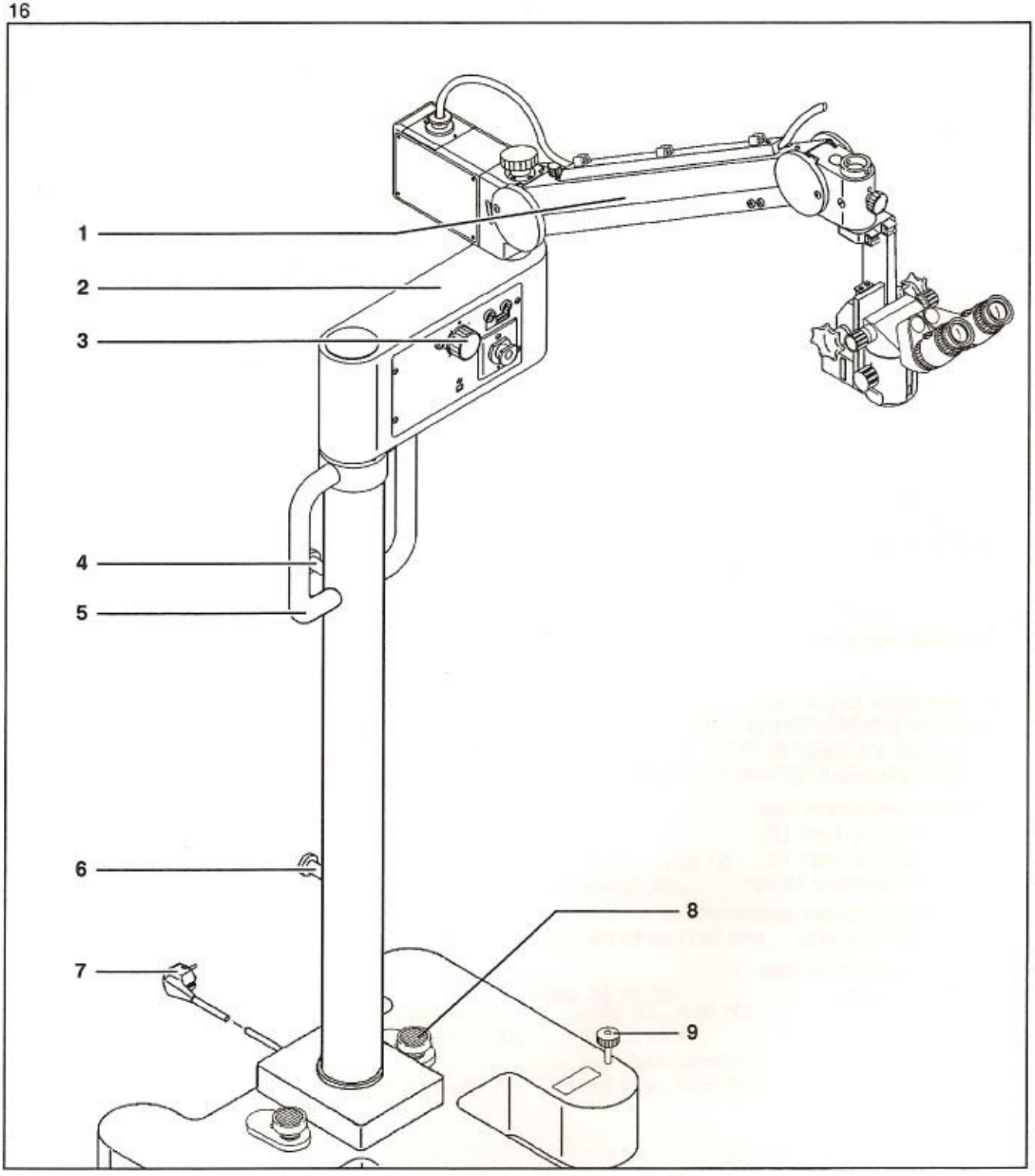
- Switch main power switch (3) off.
- In order to prevent toppling when moving the instrument, position the suspension arm (1) and the carrier arm (2) where the center of gravity is as close to the stand column as possible. See figure 15. Clamp the arms in this position with by tightening all friction adjustments.
- Unplug the power cord (7) and roll it up on bolts (4) and (6).
- Loosen lock screws (9).
- Release the floor brake knobs (8). To do this, press the toeplate underneath the knob. You can now roll the stand.
- When moving the stand, use handles (5).
- Avoid collisions of any kind.
- Do not go over steps or edges. The stand might topple!

15



- Be extremely careful when moving over slopes.
- Do not park the stand on a slope.
- At new location, push in lock knobs (8) so that the stand can no longer be rolled. In addition, tighten screws (9).

16



Spare parts (figure 17)

		Catalog number
1	Halogen lamp 12 V, 100 W	00 79- 9040
	Cleaning cloths for optical components, pack of 100 (not shown)	30 61 18- 0000
	Antifogging agent (not shown)	30 55 50- 9910

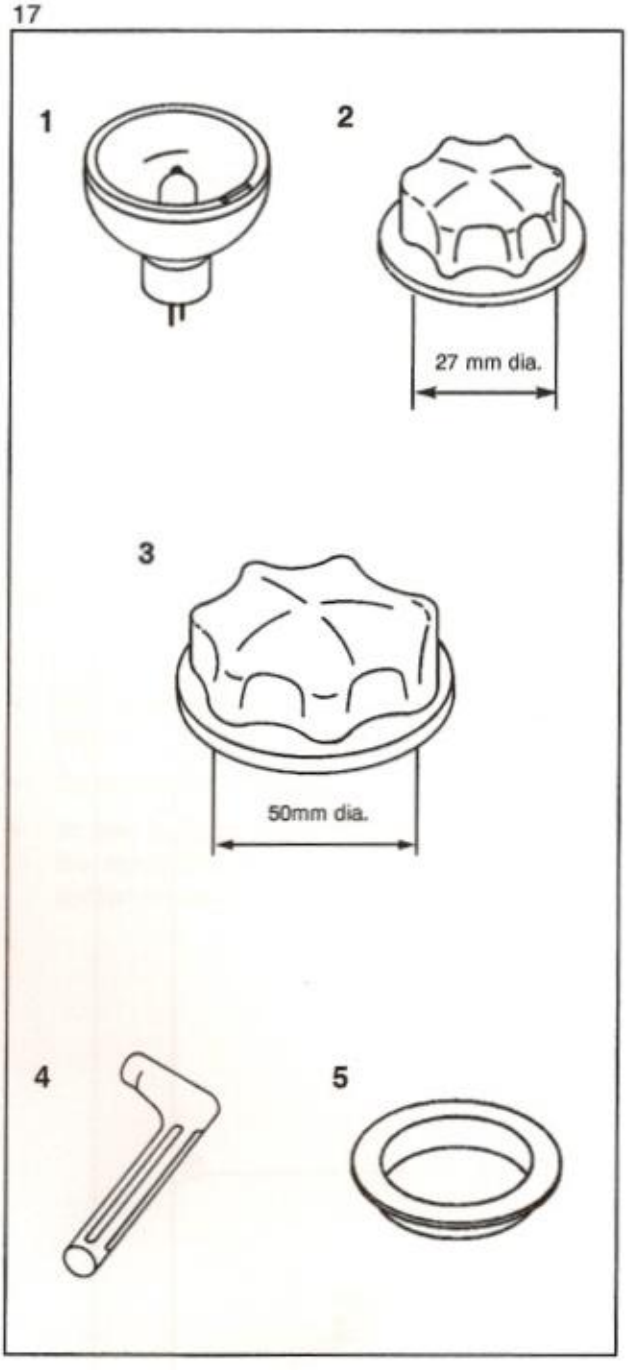
Accessories

Please observe the following:
Only operate the instrument with the accessories included in the delivery package. If you want to use other accessories, make sure that Carl Zeiss or the manufacturer of the accessories has proved and confirmed that these accessories meet the respective technical safety standards and can be used without risk.

Asepsis (figure 17)

		Catalog number
2	Sterilizable rubber cap for magnification changer (8), see figure 3, page 13, internal diameter 27 mm.	30 58 07- 0000
3	Sterilizable rubber cap for focussing knob (7), see figure 3, page 13, internal diameter 50 mm.	30 58 03- 0000
4	Sterilizable rubber cap for OPMI® handles	30 58 08- 0000
5	Sterilizable rubber cap for objectives	30 36 88- 0000

17



OPMI® 1 FC Surgical Microscope

Supply	electrical supply for surgical microscope from suspension system
Tube / eyepieces	f = 170 mm binocular inclined tube, widefield screw-type 10x/22B eyepieces with integrated eyecups, other tubes (straight or inclined, with various focal lengths) and eyepieces (with various magnifications) available
Objectives	carrier ring with objective, f = 175 mm, outer dia. 56 mm, other objectives available with outer dia. of 48 mm, f = 200 mm to f = 400 mm in steps of 25 mm
Magnification	manual magnification changer 5 stages: γ = 0.4x; γ = 0.6x; γ = 1.0x; γ = 1.6x; γ = 2.5x
Focussing	manual focus drive, range: 50 mm
Rotation range	vertical axis 360°, horizontal axis 330°
Illumination	coaxial illumination, FC oblique illumination available, light supply via fiber light guide for 12 V, 100 W halogen reflector lamp light source in suspension system.
Catalog number	OPMI® 1 FC Surgical Microscope, 30 33 22- 0000
Weight of Microscope body	2.0 kg
Max. allowable load on S21 suspension arm	When used with the S21 Floor Stand, the weight of the microscope and all the microscope accessories must not exceed 11 kg. For other suspension systems, see the respective user manual.

Ambient conditions	Temperature	10 °C... + 40 °C
	Relative humidity	30%...90% (without condensation)
	Air pressure	700 hPa...1060 hPa
Transportation and storage in packing used for shipping	Temperature	– 40 °C... + 70 °C
	Relative humidity	10%...100% (with condensation)
	Air pressure	500 hPa...1060 hPa

Sterilization Methods

Gas (ETO) Sterilization*

Standard ETO is acceptable for use with Kraton® thermoplastic rubber based compounds. The ETO gas will penetrate the Kraton, plasticize it and relieve molded in stresses or imposed stresses on the part.

Aeration time is greatly dependent on the size of the master carton and its permeability. One week is the minimum requirement to bring the ETO residuals below 1 PPM, as tested by the standard liquid extraction method. If the product is heated to 125-135 F in an aeration chamber with high airflow, the time can be accelerated to as little as four days.

Gamma Sterilization*

Kraton thermoplastic rubber can be sterilized using gamma radiation without suffering a large loss in physical properties even after extended storage.

Kraton G-2705 rubber was exposed to Cobalt 60 radiation doses of 3, 6, and 12 Mrads. The table below shows the effect of the radiation on the tensile properties of the material after being aged for 21 months.

Property	Original	0 Mrads	3 Mrads	6 Mrads	12 Mrads
Hardness, Shore A	55	50	48	48	43
Tensile Strength, psi	1200	+8%	+12%	-3%	-15%
300% Modulus, psi	350	+3%	-4%	-10%	-15%
Elongation, %	700	+3%	+10%	+8%	+12%

Steam Sterilization*

GLS Corporation can suggest the following maximum autoclave cycles for selected materials**

250 F for 17 minutes

240 F for 27 minutes.

There will be some slippage or creep with any Kraton thermoplastic rubber based products at these temperatures because of the relieving of molded in stress and the relaxation of imposed stresses. To minimize these effects, parts should be molded at the suggested processing conditions, and not autoclaved while being subjected to outside mechanical stresses.

* Information pertains only to Kraton G-based compounds
** Information pertains only to Kraton G-2705 compound.

Disposables

Endure Number		
	Spare Bulbs	
90-1200	Zeiss 6V 30W Bt58Z	390158
90-1201	Zeiss 6V 50W Bt86Z	390186
90-1202	Zeiss 12V 100W HLX #64626	380075 1020
90-1203	EFR Housing #900	
90-1204	Zeiss 15V 150W EFR	310198
90-1205	Zeiss 12V 100W HLX #64627	380079 9040
90-1206	Zeiss Superlux 40	
90-1207	Zeiss Superlux 175	
90-1208	Zeiss Superlux 300 with Cartridge	
90-1209	Zeiss Superlux 300 Bulb Only - No Housing or Meter	
90-1302	ELS 150 21V 150W EKE	
90-1400	ELS 250 24V 250W ELC	
90-1403	ELS 24 60V 24W Metal Halide	
90-1402	ILO 300W with Cartridge	
	Sterilizable Knob Covers	
91-0100	Zeiss Knob Cover, MD Zoom	302602 0203
91-0101	Zeiss Knob Cover, 0-60 PD Adjustment	303418 0000
91-0102	Zeiss Knob Cover, Small, 0-180 PD Adjustment	305810 0000
91-0103	Zeiss Knob Cover, Medium,	305807 0000
91-0104	Zeiss Knob Cover, Magnification Changer	303673 0000
91-0105	Zeiss Knob Cover, Large	305803 0000
91-0106	Zeiss Knob Cover, Extra Large	303674 0000
91-0110	Zeiss Handle Cover, CS/MD Short	302501 9060
91-0111	Zeiss Handle Cover, CS/MD Long	302627 9001
91-0112	Zeiss Handle Cover, F-Cover	305808 0000
91-0113	Zeiss Handle Cover, Pro Magis	
91-0114	Zeiss Hande Cover for MDU Post	305809 0000
	Dust Covers	
92-0010	Dust Cover, Large	
	Foot Control Covers	
92-0200	Endure Poncho Disposable Foot Control Cover, 20 per Case	
	Drapes	
93-8222	Sterile Drape, 50/180cm, 20/70", Zeiss 48mm, Zeiss OPMI 1/OPMI 6 w/o Side Observer, 20 per Case	
93-8214	Sterile Drape, 115/180cm, 45/70", Zeiss 48mm, Zeiss OPMI 1/OPMI 6 w/Side Observer, 20 per Case	
93-8296	Sterile Drape, 115/300cm, 45/118", Zeiss 65mm, MD/CS/11/111/ORL/Pro Magis/Neuro/ VISU 150/VISU 200, 20 per Case	